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ABSTRACT

The Austin (Texas) Science and Mathematics Consortium funded by a 4-year grant that has 2 basic goals: to improve the skills of K-12 teachers in science and mathematics and to increase student learning and performance in science concepts. Program activities, which began in 1990-91, focus on four components: curriculum development, staff development, student participation, and private sector involvement. This evaluative report relates findings that emerged from survey data collected from participating teachers and students. The three new curricula piloted during 1991-92 focused on environmental issues and received positive ratings from the piloting teachers. Most students who participated in the pilot curricula projects reported an increased knowledge and awareness of environmental issues. Some students reported increased interest in science. During the three staff development institutes held for teachers during the summer of 1991, teachers received training in educational technology and curriculum development. As a result of the Technology Institute, teachers reported an increase in both their computer skills and classroom use. However, few of the teachers who participated in the institute on water pollution consistently monitored their curriculum-related activities, resulting in little information on the impact of this staff development activity. The program included extensive private sector involvement. (IAH)

Technology, Training, and Curricula Revisited:

The National Science Foundation Grant to The Science Academy of Austin 1991-92

Final Report

August 1992

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Technology, Training, and Curricula Revisited: The National Science Foundation Grant to the Science Academy of Austin 1991-92

Austin Independent School District
Department of Management Information
Office of Research and Evaluation

Executive Summary

Author: Lydia Williams-Robertson

Program Description

The Austin Science and Mathematics Consortium, funded by a four-year grant from the National Science Foundation (NSF) and implemented beginning in 1990-91, has two basic goals:

- To improve the skills of teachers (K-12) in science and mathematics, and
- To increase student learning and performance in science concepts.

To address these goals, the NSF grant activities are divided into four components.

Curriculum Development

During the 1991-92 academic year the following curricula were piloted in selected AISD schools. Teachers and their students (where appropriate) were surveyed to determine actual usage and implementation of the following curricula.

- The Biological Sciences Curriculum Study (BSCS) Science for Life and Living was piloted at Becker and Harris Elementary Schools,
- The Planet Earth was piloted at the Science Academy, and
- The Nonpoint Source Pollution (NPS) Curriculum was piloted at Dobie, Murchison, O'Henry Middle Schools, as well being distributed to middle school teachers outside of AISD.

Staff Development

During the summer of 1991, training institutes were held for selected teachers to receive training in technology and in curriculum development. Teachers (and their students where appropriate) were surveyed to determine their implementation and utilization of the training they received during any of the following institutes.

- The Technology Institute
- The BSCS Training Institute
- The Colorado River Watch Network (CRWN) Training Institute

Student Participation

Science Academy students conducted outreach activities with the students of teachers who attended any of the summer institutes in 1991.

Private Sector Involvement

Private sector involvement was extensive. A previous publication, *Forming Linkages and Private Sector Partnerships: The National Science Foundation Grant to The Science Academy of Austin 1991-92* (ORE Pub. No. 91.11) reported private sector involvement in detail.

Major Findings

1. The Technology Institute (TI) appears to have been effective in improving teachers computers skills. After attending TI, teachers reported an increase in their computer literacy, the number of hours of classroom computer use, and the range of computer activities in which they engaged (pp. 6-7).

2. The three new curricula that were piloted in AISD were rated positively by the piloting teachers (pp. 2-3).

3. After studying the Get to the Point! curricula, the students surveyed reported a significant increase in their knowledge and interest in water quality issues (p. 4).

4. After taking The Planet Earth course, most of the Science Academy students surveyed reported an increase in their ability to find and organize information (p. 5).

5. Few of the teachers who attended the CRWN Training Institute documented their water monitoring activities consistently (p. 8).

6. Students participating in the CRWN activities reported an increase in awareness of environmental issues, and some reported an increased interest in science (p. 8).

Budget Implications

Mandate:
Required by School Board Policy; required by funding source

Funding Amount:
$ 103,397

Funding Source:
Federal (National Science Foundation)

Implications:
Supports AISD's fifth strategic objective, "AISD will upgrade the quality of course content and the effectiveness of instruction"; provided teachers with training in educational technology, resulting in increased usage of technology in the classroom; developed new science curricula; forged linkages between the private sector and AISD; increased some students' interest in science

PROGRAM EFFECTIVENESS SUMMARY

The National Science Foundation Grant, 1991-92

Cost	Effect	Grant Component
$$	+	Staff Development
$$		Curriculum Development
$		Student Participation
$	+	Private Sector Involvement

Effect	is expressed as contributing to any of 5 AISD strategic objectives
+	*Positive*, needs to be maintained or expanded
0	*Not significant*, needs to be improved and modified
-	*Negative*, needs major modification or replacement
Blank	*Unknown*

Cost	is the expense over the regular District per-student expenditure
0	*No cost*, or minimal cost
$	*Indirect costs*, and overhead, but no separate budget
$$	*Some direct costs*, but under $500 per student
$$$	*Major direct costs*, for teachers, staff, and/or equipment in the range of $500 per student or more

Cost ratings for the Staff Development and Curriculum Development components are based on estimates of the numbers of students potentially affected by the training their teachers received, and/or the new curricula to which they were exposed.

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Technology, Training, and Curricula Revisited: The National Science Foundation Grant to the Science Academy of Austin 1991-92

INTRODUCTION

The National Science Foundation (NSF) grant to the Science Academy of Austin is a four-year grant. It is atypical in that it does not conform to the academic year cycle (July to June), but begins in January each year. The first year of the grant (beginning in January 1991) focused on implementation and was detailed in Technology, Training, and Curricula for Tomorrow's Classrooms: The National Science Foundation Grant to The Science Academy of Austin 1990-91 (ORE Pub. No. 90.37). That report included information about the implementation of the training and curriculum writing institutes held that year.

All of the institutes were conducted during the summer. Consequently, the participating teachers had no opportunity to implement the training or curricula in their classrooms until the following school year (1991-92). This report will follow up on those teachers who attended training in the summer of 1991, focusing on the following areas:

Classroom Implementation

- Did the participating teachers actually use their new skills in their classrooms?
- Was there any change in the teachers' classroom teaching or activities?
- Did the technology training affect teachers' level of computer use?

Curriculum Piloting

- How did teachers implement the new curricula in their classrooms?
- How did teachers rate the new curricula?
- How did the students rate the new curricula?

Demographics

- How many teachers participated?
- What was the ethnicity and sex of the participants?

CURRICULUM DEVELOPMENT

The Science for Life and Living curriculum was piloted at Becker and Harris Elementary Schools. All of the teachers modified the curriculum in some way. Almost all of the teachers rated their students' response to the curriculum as positive.

The Get to the Point! curriculum was piloted at four AISD middle schools. The majority of the teachers rated their students' response to the curriculum as positive. Overall, the students' ratings of the curriculum were positive. As a result of studying the curriculum, the students reported that their knowledge of water quality issues increased.

The Planet Earth curriculum was piloted at the Science Academy as a required course for the tenth grade. Student evaluations were mixed. Most of the students rated the curriculum as "moderately difficult" or "challenging." Most of the students reported a moderate or dramatic increase in "my ability to find and organize information."

In the summer of 1991, three curriculum development workshops were conducted during which three new curricula were written (Williams-Robertson, 1991). These curricula were piloted during the 1992-93 school year by the participating teachers. In May 1992, follow-up surveys were sent to these teachers to determine the ways in which the curricula were implemented. In some cases students were surveyed as well. This section of the report will briefly describe each curriculum and report survey results.

Science for Life and Living

This curriculum was developed by the Biological Sciences Curriculum Study (BSCS) an organization that develops science curricula. Developed for students in grades K-6, this curriculum integrates science, technology, and health. Attachment A includes the curriculum scope and sequence and a chart showing the relevant skills for each level.

The curriculum is divided into six levels each with one major concept and one major skill that integrates all three disciplines. The curriculum encourages active learning, and cooperative learning techniques are built into each lesson. A kit of hands-on materials is available for each level of the program. The curriculum also includes an implementation guide to assist administrators and teachers in implementing the curriculum in their classrooms.

Survey Summary

A total of 10 K-2 teachers from Becker and Harris Elementary Schools were trained in the use of the BSCS curriculum (Williams-Robertson, 1991). Of the 10 teachers surveyed only five returned surveys, a return rate of 50%.

Most (N=3)* of the teachers reported that they taught between 11 and 15 lessons from the curriculum. Almost all (N=4) reported that they perceived their students' response to the lessons as "very positive" or "somewhat positive." One teacher reported that she did not use the curriculum because she was transferred to a grade for which her materials were inappropriate.

* Not all of the five teachers responded to every question. The N's in parentheses refer to the number of respondents for any given question.

How did you implement the BSCS Curriculum in your classroom? (N=5)

All of the teachers modified the curriculum in some way. Some of the respondents endorsed more than one choice; therefore, the N's will not sum to five.

- Used the BSCS curriculum in conjunction with the current curriculum (2),
- Used the BSCS curriculum with my own modifications (4), and
- Did not use the BSCS curriculum (1).

How did you modify the curriculum? (N=4)

- Coordinated with AISD Science and Social Studies units (2),
- Supplemented with Optical Data, field trips, and outdoor experiments (1), and
- Used the hands-on activities (1).

What did you like most/least about the BSCS Curriculum? (N=3)

- The aspect of the curriculum that the teachers (N=3) liked the most was the hands-on activities.
- The aspect of the curriculum the teachers (N=2) liked the least was the delay in receiving the materials from the publisher.

Get to the Point!

This curriculum was written during a curriculum-writing workshop during the summer of 1991 (Williams-Robertson, 1991). It was developed for the seventh and eighth grades and deals with nonpoint source pollution (NPS), defined as water pollution not attributable to a specific source such as a factory. The curriculum is divided into two units, each with six lessons. Unit One introduces the major issues of NPS, and Unit Two provides a more in-depth examination of the previously introduced issues. Attachment B gives the learning objectives for both units. The curriculum was piloted at Murchison, Kealing, O. Henry, and Dobie Middle Schools, as well as to six middle schools outside of AISD.

Teacher Survey Summary

A survey developed by the Lower Colorado River Authority (LCRA) was administered to the 10 teachers who used the curriculum during the 1991-92 school year. Of the 10 teachers**, eight returned surveys, a return rate of 80%.

How many students were taught? How many sessions/days were used? (N=8)

- The teachers that returned surveys reported teaching the NPS curriculum to a total of 817 students; (a mean of 102, a minimum of 26, and a maximum of 108 students).
- The teachers varied in the number of sessions or days they taught the curriculum lessons; (a mean of 14 sessions, and a maximum of 25 sessions. One teacher did not teach any of the lessons).

What was the students' overall response to the curriculum? (N=7)

- The teachers responding to this question perceived their students' overall response to the curriculum as positive. The majority (6) of the teachers reported that their students' response was either "positive" or "very positive," one teacher reported a neutral response, and none reported a negative response.
- All of the teachers (N=8) reported that the lessons and activities were "just right" for their students and were satisfied with their students' progress through the material.
- All of the teachers (N=5) would teach the curriculum again.

** The surveys returned by the non-AISD teachers are included in this analysis. However, demographic data were not available for these teachers and will not be included in the demographic summary.

Student Survey Summary

A student survey also developed by the LCRA was administered to the students of the NPS curriculum pilot teachers. The teachers reported teaching the curriculum to a total of 817 students. A total of 229 students completed the survey, a return rate of 28%.

The students were required to respond to questions about the curriculum using a five-point scale, with a score of 5 indicating strong agreement with the positive statement, a score of three indicating neutrality, and a score of one indicating strong agreement with the negative statement.

Overall, the student's mean ratings were positive (see Figure 1).

FIGURE 1
STUDENT SURVEY MEAN SCORES

Survey Question	Response Range	Mean	N
Overall rating of Get to the Point!	Not Important = 1 Very Important = 5	3.83	227
The things I learned were:	Not Beneficial = 1 Very Beneficial = 5	3.83	229
The activities and exercises were:	Not Enjoyable = 1 Very Enjoyable = 5	3.50	229
As a result of this program, I plan to do more things to help prevent water pollution.	Strongly Disagree = 1 Strongly Agree = 5	4.00	228

How did the NPS curriculum affect students' knowledge of and interest in water quality issues?

The students surveyed rated their level of knowledge and interest in water quality issues significantly higher ($p > .001$) after having been taught lessons from the NPS curriculum. Figure 2 shows the mean rating before and after studying the curriculum.

FIGURE 2
STUDENT KNOWLEDGE AND INTEREST
BEFORE AND AFTER EXPOSURE TO CURRICULUM

Survey Question	Response Range	Mean	N
Before I began this program my understanding of, and interest in water quality issues were:	Very Low = 1 Very High = 5	2.76	228
As a result of studying this program my understanding of, and interest in water quality issues are:	Much Lower = 1 Much Higher = 5	3.99	228

Planet Earth

The Planet Earth curriculum is a tenth grade science curriculum integrating geology, physics, astronomy, chemistry, and biology. It was written during the summer of 1991 by Science Academy science teachers with backgrounds in the relevant areas (Williams-Robertson, 1991). The course used no textbook; the lessons included readings from a range of current

sources. Attachment C gives the curriculum course goals. The curriculum was piloted at the Science Academy in the fall, 1991 semester. It utilized a team teaching approach, was taught in tandem by two teachers, and was a required course for all tenth graders.

Student Survey Summary

An in-house survey, developed by Science Academy staff, was administered to the students in January 1991, and a summary of the survey results was provided for this report.

How did the students rate the Planet Earth course?

- Overall, almost half of the students (45%) found the course "challenging," one in three (34%) found it "moderately difficult," a small percentage (15%) found it "easy," and a few (6%) found it "very easy."
- About half of the students (52%) reported that the topics covered in the course were "sometimes a review, but generally new to me," less than half (44%) reported that the topics were "almost all new to me."
- Most of the students (71%) reported that the reading assignments were "just right," and the vast majority (82%) agreed that the reading assignments "helped me understand the topics."
- One in three (34%) reported an improvement in their ability to present oral information.
- Two thirds (66%) reported a moderate improvement in their ability to find and organize information.
- Most of the students (73%) reported that the course offered enough variety in activities.

STAFF DEVELOPMENT

The Technology Institute appears to have been successful in increasing the quality and quantity of computer use in the classrooms of the participating teachers. Almost all of the teachers responding to the follow-up survey reported that they have utilized their training in some way. In applying their training in their classrooms, more than half of the teachers have increased their computer use, in both hours per week and the range of computer activities. Less than one third of the teachers actively shared their training with the other teachers at their schools.

The Colorado River Watch Network Training Institute has been primarily effective in increasing students' awareness of environmental issues. Almost all of the student participants reported an increased awareness of environmental issues, and about half of the students reported that they are now more interested in science. Few reported an increased interest in mathematics and few reported an improvement in their mathematics grades. Few of the participating teachers carried out water quality testing with any consistency.

During the summer of 1991, three staff development workshops were held: the Technology Institute (TI), the BSCS Institute, and the Colorado River Watch Network (CRWN) Summer Institute (Williams-Robertson, 1991). In May 1992, the participating teachers were sent follow-up surveys to determine the ways in which they had utilized their training during the school year. This section of the report will briefly describe the TI and CRWN workshops and report the survey results (the BSCS curriculum was discussed in the Curriculum Development section).

The Technology Institute

This workshop was designed to expose teachers to computer technology available for classroom use and to provide demonstrations and training in its use. Teachers attended one of two eight-day workshops; classes were held in the morning, and the Science Academy computer lab was available for practice and exploratory time in the afternoon. Teachers were exposed to a wide variety of educational software.

Teacher Survey Summary

A total of 49 teachers who taught grades K-6 attended the TI. Of these, 29 completed surveys, a return rate of 59%. In responding to the first three questions, teachers could endorse more than one response choice; therefore, the percentages given will not sum to 100.

In the past year, how have you utilized your TI training? (N=29)

- Attended additional computer classes/workshops (52%)
- Set up a computer station in my classroom (52%)
- Set up a computer lab at my school (34%)
- Acquired some of the software demonstrated at the TI for my classroom (31%)
- Acquired a computer for my home (17%)
- Have not utilized my TI training (3%)

How has your TI training affected your teaching style/classroom activities? (N=28)

- Improved my computer literacy (86%)
- Increased the range of my classroom computer activities (64%)
- Increased the amount of time I use the computer in my classroom (61%)
- Increased my usage of hands-on/cooperative learning techniques (50%)
- No effect on my teaching style/classroom activities (11%)

How did you share your TI training with the other teachers at your school? (N=29)

- Talked informally with other teachers about my training (90%)
- Encouraged other teachers to attend TI next summer (55%)
- Shared my TI handouts with other teachers (52%)
- Used a staff development day to train other teachers (28%)

To assess whether the TI training had an impact on actual computer use at school or at home, the teachers were asked to report the approximate number of hours per week each spent using a computer, both before and after TI. Their responses were analyzed to determine the number of teachers whose usage increased, decreased, or did not change. More than half of the teachers (59%) increased the number of hours per week spent on a classroom computer. One teacher reported a decrease in use because her computer was removed from her classroom. Figure 3 shows the effect TI had on their classroom use.

FIGURE 3
CLASSROOM COMPUTER USE BEFORE AND AFTER ATTENDING TI

Change in Use	N	%
Increased Use	17	59
Decreased Use	1	3
No Change in Use	7	24
Didn't Have/Use Computer	4	14

Attending TI had less of an effect on home computer use, possibly because almost half of the teachers (45%) reported that they do not have a home computer. Overall, 28% of the teachers increased their computer use at home. However, it is important to note that this percentage represents half of the teacher who have home computers. Figure 4 shows the effect TI had on the teachers' home computer use.

FIGURE 4
HOME COMPUTER USE BEFORE AND AFTER TI

Change in Use	N	%
Increased Use	8	28
Decreased Use	0	0
No Change in Use	8	28
Didn't Have/Use Computer	13	45

The Colorado River Watch Network (CWRN) Training Institute

The LCRA sponsors training workshops three times a year to train teachers, students, and other citizens in water quality testing to assist them in monitoring water quality throughout the 10-county Colorado River area. Teachers may have attended any one of the three training workshops throughout the year. These teachers would then recruit students in their classes to conduct water quality testing throughout the school year.

Teacher Survey Summary

Twelve AISD teachers attended the CWRN training during the 1991-92 school year. In May of 1992, these teachers were surveyed to determine if they carried out the testing, how many of their students participated, and their perception of their students' enthusiasm. Of the 12 teachers from AISD, six completed follow-up surveys, a return rate of 50%. All of the teachers rated the training they received as either "very effective" (4), or "somewhat effective" (2).

All of the teachers (N=6) reported conducting water quality testing during the year; however, few were consistent in sending their weekly data reports to the LCRA. The mean number of data reports sent over the year was 12, the maximum number of data reports sent was 52, the minimum was none (0).

The teachers reported a total 127 participating students, with a mean of 21 students; the maximum was 46 students, the minimum was five students. The teachers rated their students as being "very enthusiastic" (5), or "somewhat enthusiastic" (1).

Student Survey Summary

The participating high and middle school students (N=40) were surveyed in May 1992. The student surveys were sent to the participating teachers to administer to their students, therefore the only students who returned surveys were those whose teacher completed a survey. A total of 81 participating middle/high school students was reported in the teachers' survey; a total of 40 surveys was received, a return rate of 49%.

How important is your participation in the CWRN? (N=40)

- Half of the students (50%) rated their participation as "very important,"
- One third (30%) rated it as "somewhat important," and
- One in five (20%) was neutral.

Nearly all (92%, N=40) of the students would encourage their friends to participate in the CWRN, although a smaller percentage (69%, N=39) reported that they plan to continue participating after this year.

In responding to the next two questions, students were able to endorse more than one response choice; therefore, the percentages will not sum to 100.

What made you want to participating the CWRN? (N=40)

- I have always been interested in the environment (52%).
- My teacher made it sound interesting (45%).
- The whole class participated (30%).
- My teacher offered me extra credit (22%).

How has participating in the CWRN affected you? (N=40)

- I know more about environmental issues (90%).
- I am more interested in science (52%).
- My science grades are better (20%).
- My participation has not affected me (7%).
- My mathematics grades are better (2%)
- I am more interested in mathematics (2%).

STUDENT PARTICIPATION

Except for the students who participated in the CWRN water quality testing, there was little direct student involvement. The majority of the students participated indirectly through the curriculum piloting. Becker Elementary School was the exception. In May of 1992, Becker Elementary students participated in a National Geographic Video Conference held at IBM. During this video conference Becker elementary students communicated with students from Georgia, New York, Connecticut, and Maryland.

Science Academy students participated in the following outreach activities during the 1991-92 school year:

- Taking Becker and Harris elementary students on a field trip to Zilker Park and Nature Center,
- Conducting a physics circus at Becker, Harris, and Lee Elementary Schools, and Martin Junior High School.
- Acting as judges for the a science fair at Summitt Elementary School.

PRIVATE SECTOR INVOLVEMENT

Private sector participants have provided expertise and support for the all aspects of the NSF grant activities, and was so extensive that it was reported in a separate publication (Williams-Robertson, 1992). During the 1991-92 school year, participants from the following were involved:

- 18 local companies and businesses,
- 11 city and state agencies,
- 2 national agencies,
- 3 institutions of higher education, and
- 5 school districts.

DEMOGRAPHICS

A total of 78 teachers*** participated in the grant activities of 1991-92. Of these, 70 were AISD teachers (unduplicated count). Some of the teachers participated in more than one grant activity.

Sex and Ethnicity

Most (80%) of the teachers who participated in the 1991-92 grant activities were female. Two thirds (68%) of the participating teachers of the teachers were White, one in five (20%) was Hispanic, a small percentage (10%) was African-American, and 1% were Other.

AISD Experience

The largest proportion of teachers (43%) were relatively new to AISD, with 1-5 years of AISD experience. A small percentage (14%) had 6-10 years, one in four (24%) 11-15 years, a few (16%) had 16-20, and a very small percentage had between 21-25 years with AISD.

*** Demographic information was not available for the eight teachers from other school districts, therefore the analysis of the overall demographics will only include the 70 teachers from AISD.

REFERENCES

Williams-Robertson, L. (1992, March). Forming linkages and private sector partnerships: The National Science Foundation grant to the Science Academy of Austin (ORE Pub. No. 91.11). Austin, TX: Austin Independent School District, Office of Research and Evaluation.

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ATTACHMENT A

Science for Life and Living

SCIENCE FOR LIFE AND LIVING Scope and Sequence Chart

K AWARENESS OF MYSELF AND MY WORLD			
	Science	**Technology**	**Health**
1 ORDER AND ORGANIZATION			
Introduction to Order and Organization	Objects and Properties	Materials and Structures	Safety and Security
2 CHANGE AND MEASUREMENT			
Introduction to Change and Measurement	Comparison and Evidence	Tools and Machines	Wellness and Personal Care
3 PATTERNS AND PREDICTION			
Introduction to Patterns and Prediction	Records and Data	Construction and Testing	Nutrition and Dental Care
4 SYSTEMS AND ANALYSIS			
Introduction to Systems and Analysis	Interactions and Variables	Problems and Solutions	Self and Substances
5 ENERGY AND INVESTIGATION			
Introduction to Energy and Investigation	Energy Chains and Food Chains	Design and Efficiency	Fitness and Protection
6 BALANCE AND DECISIONS			
Introduction to Balance and Decisions	Ecosystems and Resources	Constraints and Trade-Offs	Communication and Conflict

The above chart was reproduced from BSCS course materials

ATTACHMENT A (cont.)

Team Skills and Social Skills Emphasized in *Science for Life and Living*

Unit	Team Skills	Social Skills
Level 1		
Science	Share the things you use.	Shared Leadership
Technology	Tell others when they do a job well.	Trust Building
Health	Ask for help and give help.	Communication
Level 2		
Science	Listen when others talk.	Communication
Technology	Show others when you are happy for them.	Trust Building
Health	Ask for help and give help.	Communication
Level 3		
Science	Take turns talking.	Shared Leadership
Technology	Look for evidence before you change your mind.	Conflict Management
Health	Show interest in what others say.	Communication
Level 4		
Science	Share your ideas.	Communication
Technology	Show respect for one another's ideas.	Trust Building
Health	Avoid put-downs.	Communication
Level 5		
Science	Talk about several answers before choosing one.	Shared Leadership
Technology	Add to another person's ideas.	Communication
Health	Criticize ideas, not people.	Trust Building
Level 6		
Science	Ask questions to help you understand one another's point of view.	Conflict Management
Technology	Discuss many ideas before selecting one.	Shared Leadership
Health	State someone else's opinion that is different from your own.	Conflict Management

The above chart was reproduced from BSCS course materials

ATTACHMENT B

Get To The Point! Curriculum Learning Objectives

Unit 1

1. Students will be able to describe the importance of water in their personal lives by analyzing the distribution of water on earth.

2. Students will be able to:

    1) Identify some of our uses of water that deplete water quantity and harm water quality,
    2) Describe their personal values about the problem of environmental pollution, and
    3) Identify basic actions they can take to improve environmental quality.

3. Students will be able to define point and nonpoint pollution, identify water pollution sources, and classify each as a point or nonpoint source.

4. Students will review the various elements of the hydrologic cycle and describe the relationship between those elements and the potential for causing or spreading water pollution when runoff from precipitation moves across the land.

5. Students will compare the importance of major river systems of Texas with fresh water sources in other areas of the country and describe global consequences of nonpoint pollution in terms of:

    1) fresh water and ocean contamination,
    2) its effects on modern urban communities, rain forests, and other biomes.

6. Students will be able to:

    1) Give examples of individual actions that have a positive effect on the abatement of nonpoint pollution.
    2) Adopt personal lifestyle activities that reduce nonpoint pollution.
    3) Participate in community clean-up projects on creeks and rivers.
    4) Identify local plants that are suitable for their climate and plan a Xeriscape lawn for their school or home.

Unit 2

1. Students will be able to :

    1) Discuss the short-term and long-term ramifications of nonpoint pollution on the quality and duration of human life.
    2) Describe the economic impact of water pollution in their own language.
    3) Compare the costs of prevention of nonpoint water pollution with the cost of cleanup after the pollutant enters a river, lake, or aquifer.
    4) Give examples of the medical expenses for the individual and society of someone who has cancer caused by toxic chemicals.

2. Students will be able to:

    1) Describe the types of human activities of the land that produce water pollutants.
    2) Relate the types of contaminants in nonpoint pollution to their sources.

3. Students will be able to correlate how various nonpoint pollutants such as excessive nutrients and toxins affect organisms in specific ecosystems near students' school or homes.

4. Students will identify a human's position in the food chain, explain how biomagnification occurs, and discuss its consequences for populations in the food chain.

5. Students will be able to describe successful examples from around the country of abatement of nonpoint sources of water pollution and discuss the importance of total watershed management for the cleanup of nonpoint pollution sources.

6. Students will present logical arguments for different sides of nonpoint issues, debate the feasibility of various solutions to given problems, and identify ways in which individual groups or organizations can be effectively involved in community decisions.

ATTACHMENT C

Planet Earth Curriculum Course Goals

At the completion of Planet Earth, students will be able to:

1. Describe the intimate relationships between the physical and chemical aspects of the earth and earth's ability to provide a habitat for life.

2. Evaluate the prospects for "sustainable human development on a planet with finite resources and a fragile environment." (from "Managing Planet Earth")

3. Communicate an understanding of the dynamics of planet earth, including its place within the solar system, and the internal processes which shape the major external features of the earth.

4. Demonstrate a historical perspective of life on earth, including its origin, diversification and future directions.

5. Use concepts from physics, chemistry, biology, meteorology, astronomy, and mathematics to understand important issues related to planet earth.

6. Articulate a personal and community environmental ethics stance in regards to global management in the face of global change.

7. Communicate an understanding of the role of current and future technologies in the identification and solution of global problems.

8. Demonstrate competency in using current technologies to access, organize, synthesize, evaluate, and present information.

9. Apply scientific principles to personal interests ad hobbies, and to the consideration of potential careers.

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